

SECTION 02780

UNIT PAVERS

PART 1 - GENERAL

0.1 DESCRIPTION OF WORK

- A. Work Included: This Section specifies the following items:
1. Brick pavers set in bituminous and mortar setting beds.
 2. Concrete pavers set in bituminous and mortar setting beds.
 3. Asphalt-block pavers set in bituminous setting beds.
 4. Steel edge restraints.
 5. Cast-in-place concrete edge restraints.
- B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
1. Section 02300 - EARTHWORK; excavation and compacted subgrade.
 2. Section 02513 - BITUMINOUS CONCRETE PAVEMENT; for asphalt base under unit pavers.
 3. Section 02524 - CURBS, GUTTERS AND WALKS; for cast-in-place concrete curbs and gutters serving as edge restraint for unit pavers.
 4. Section 03300 - CAST-IN-PLACE CONCRETE; for concrete base under unit pavers.
 5. Section 07920 - JOINT SEALANTS; sealing control and expansion joints in unit pavers with elastomeric sealants.

0.2 SUBMITTALS

- A. Product Data: For materials other than water and aggregates, including the following:
1. Pavers.
 2. Bituminous setting materials.
 3. Mortar and grout materials.
 4. Edge restraints.
- B. Sieve Analyses: For aggregate setting-bed materials, according to ASTM C 136.
- C. Samples for Initial Selection: For the following:
1. Each type of unit paver indicated.
 2. Joint materials involving color selection.
 3. Exposed edge restraints involving color selection.

D. Samples for Verification:

1. Full-size units of each type of unit paver indicated. Assemble not less than five Samples of each type of unit on suitable backing and grout joints.
2. Joint materials.
3. Exposed edge restraints.

E. Compatibility and Adhesion Test Reports: From latex-additive manufacturer for mortar and grout containing latex additives.

0.3 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of unit paver, joint material, and setting material from one source with resources to provide materials and products of consistent quality in appearance and physical properties.

B. Preconstruction Compatibility and Adhesion Testing: Submit to latex-additive manufacturer, for testing indicated below, samples of paving materials that will contact or affect mortar and grout that contain latex additives.

1. Use manufacturer's standard test methods to determine whether mortar and grout materials will obtain optimum adhesion with, and will be nonstaining to, installed pavers and other materials constituting paver installation.

C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1.

0.4 DELIVERY, STORAGE, AND HANDLING

A. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Store liquids in tightly closed containers protected from freezing.

- E. Store asphalt cement and other bituminous materials in tightly closed containers.

0.5 PROJECT CONDITIONS

- A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.
- B. Weather Limitations for Bituminous Setting Bed:
 - 1. Install bituminous setting bed only when ambient temperature is above 40 deg F and when base is dry.
 - 2. Apply asphalt adhesive only when ambient temperature is above 50 deg F and when temperature has not been below 35 deg F for 12 hours immediately before application. Do not apply when setting bed is wet or contains excess moisture.
- C. Weather Limitations for Mortar and Grout:
 - 1. Cold-Weather Requirements: Protect unit paver work against freezing when ambient temperature is 40 deg F and falling. Heat materials to provide mortar and grout temperatures between 40 and 120 deg F. Provide the following protection for completed portions of work for 24 hours after installation when the mean daily air temperature is as indicated: below 40 deg F, cover with weather-resistant membrane; below 25 deg F, cover with insulating blankets; below 20 deg F, provide enclosure and temporary heat to maintain temperature above 32 deg F.
 - 2. Hot-Weather Requirements: Protect unit paver work when temperature and humidity conditions produce excessive evaporation of setting beds and grout. Provide artificial shade and windbreaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and higher.
 - a. When ambient temperature exceeds 100 deg F, or when wind velocity exceeds 8 mph and ambient temperature exceeds 90 deg F, set pavers within 1 minute of spreading setting-bed mortar.

PART 2 - PRODUCTS

0.1 BRICK PAVERS

- A. Brick Pavers: Light-traffic paving brick; ASTM C 902, Class SX, Type I, Application PS. Provide brick without frogs or cores in surfaces exposed to view in the completed Work.
 - 1. Type, thickness, face size and color as indicated on the Drawings.

- B. Efflorescence: Brick shall be rated "not effloresced" when tested according to ASTM C 67.
- C. Temporary Protective Coating: Precoat exposed surfaces of brick pavers with a continuous film of a temporary protective coating that is compatible with brick, mortar, and grout products and can be removed without damaging grout or brick. Do not coat unexposed brick surfaces.

0.2 CONCRETE PAVERS

- A. Concrete Pavers: Solid interlocking paving units complying with ASTM C 936 and resistant to freezing and thawing when tested according to ASTM C 67, made from normal-weight aggregates.
 - 1. Type, thickness, face size and color as indicated on the Drawings.

0.3 ASPHALT-BLOCK PAVERS

- A. Asphalt-Block Pavers: Solid units made from asphalt cement complying with ASTM D 312, Type III; inorganic stone dust or cement filler; and coarse aggregate, consisting of clean, hard, unweathered stone crushed into angular particles varying in size up to 3/8 inch.
 - 1. Type, thickness, face size and color as indicated on the Drawings.
 - 2. Dimensional Tolerances: Plus or minus 1/16 inch.
 - 3. Finish: Natural, smooth.
 - 4. Color: <Insert color>.

0.4 ACCESSORIES

- A. Steel Edge Restraints: Painted steel edging 3/16 inch thick by 4 inches high with loops pressed from or welded to face to receive stakes at 36 inches o.c., and steel stakes 15 inches long for each loop.
 - 1. Profiles: As indicated on the Drawings.
 - 2. Color: As selected by Engineer from manufacturer's full range.
- B. Job-Built Concrete Edge Restraints: Comply with requirements in Section 03300 - CAST-IN-PLACE CONCRETE for normal-weight, air-entrained, ready-mixed concrete with minimum 28-day compressive strength of 4,000 psi.

0.5 BITUMINOUS SETTING-BED MATERIALS

- A. Primer for Base: ASTM D 2028, cutback asphalt, grade as recommended by unit paver manufacturer.
- B. Fine Aggregate for Setting Bed: ASTM D 1073, No. 2 or No. 3.

- C. Asphalt Cement: ASTM D 3381, Viscosity Grade AC-10 or Grade AC-20.
- D. Neoprene-Modified Asphalt Adhesive: Paving manufacturer's standard adhesive consisting of oxidized asphalt combined with 2 percent neoprene and 10 percent long-fibered mineral fibers containing no asbestos.
- E. Sand for Joints: Fine, sharp, washed, natural sand or crushed stone with 100 percent passing No. 16 sieve and no more than 10 percent passing No. 200 sieve.
 - 1. Provide sand of color needed to produce required joint color.

0.6 MORTAR SETTING-BED MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Sand: ASTM C 144.
- D. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gauging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement mortar bed, and not containing a retarder.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering latex additives that may be incorporated into the Work include, but are not limited to, the following:
 - a. Boiardi Products Corporation.
 - b. Bostik Findley Inc.
 - c. C-Cure.
 - d. Laticrete International, Inc.
 - e. MAPEI Corp.
- E. Water: Potable.
- F. Reinforcing Wire: Galvanized, welded, 0.062-inch-diameter wire; 2-by-2-inch mesh; comply with ASTM A 185 and ASTM A 82 except for minimum wire size.

0.7 GROUT MATERIALS

- A. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement, unfading mineral pigments and white or colored sand as required to produce required color.
 - 1. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gauging water, of type specifically

recommended by latex-additive manufacturer for use with field-mixed sand-portland cement grout.

- B. Grout Colors: As selected by Engineer from manufacturer's full range.
- C. Water: Potable.

0.8 BITUMINOUS SETTING-BED MIX

- A. Mix bituminous setting-bed materials at an asphalt plant in approximate proportion, by weight, of 7 percent asphalt cement to 93 percent fine aggregate, unless otherwise indicated. Heat mixture to 300 deg F.

0.9 MORTAR AND GROUT MIXES

- A. General: Minimum grout strength 4,000 psi and minimum mortar strength 3,000 psi. Comply with referenced standards and with manufacturers' written instructions for mix proportions, mixing equipment, mixer speeds, mixing containers, mixing times, and other procedures needed to produce setting-bed and joint materials of uniform quality and with optimum performance characteristics. Discard mortars and grout if they have reached their initial set before being used.
- B. Mortar-Bed Bond Coat: Mix neat cement or cement and sand with latex additive to a creamy consistency.
- C. Latex-Modified, Portland Cement Setting-Bed Mortar: Proportion and mix portland cement, sand, and latex additive for setting bed to comply with written instructions of latex-additive manufacturer and as necessary to produce stiff mixture with a moist surface when bed is ready to receive pavers.
- D. Latex-Modified, Portland Cement Slurry Bond Coat: Proportion and mix portland cement, sand, and latex additive for slurry bond coat to comply with written instructions of latex-additive manufacturer.
- E. Job-Mixed, Polymer-Modified Portland Cement Grout: Add liquid-latex additive to portland cement and sand in proportion and concentration recommended by liquid-latex manufacturer. Proportion cement and sand to comply with written instructions of latex-additive manufacturer.
 - 1. Pigmented Grout: Select and proportion pigments with other ingredients to produce color required. Do not exceed pigment-to-cement ratio of 1:10, by weight.
- F. Packaged, Polymer-Modified Grout Mix: Proportion and mix grout ingredients according to grout manufacturer's written instructions.

PART 3 - EXECUTION

0.1 EXAMINATION

- A. Examine areas indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 2. Where pavers are to be installed over waterproofing, examine waterproofing installation, with waterproofing Installer present, for protection from paving operations. Examine areas where waterproofing system is turned up or flashed against vertical surfaces and horizontal waterproofing. Proceed with installation only after protection is in place.

0.2 PREPARATION

- A. Remove substances from concrete substrates that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.
- B. Clean concrete substrates to remove dirt, dust, debris, and loose particles.

0.3 INSTALLATION, GENERAL

- A. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be visible in finished work.
- B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.
- C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.
 - 1. For concrete pavers, a block splitter may be used.
- D. Exercise care in handling coated brick pavers to prevent coated surfaces from contacting backs or edges of other units. Remove coating from bonding surfaces before setting brick.
- E. Joint Pattern: Running bond.
- F. Pavers over Waterproofing: Exercise care in placing pavers and setting materials over waterproofing so protection materials are not displaced and waterproofing is not punctured or otherwise damaged. Carefully replace

protection materials that become displaced and arrange for repair of damaged waterproofing before covering with paving.

1. Provide joint filler at waterproofing that is turned up on vertical surfaces, unless otherwise indicated; where unfilled joints are indicated, provide temporary filler or protection until paver installation is complete.
- G. Tolerances: Do not exceed 1/32-inch unit-to-unit offset from flush (lippage) nor 1/8 inch in 10 feet from level, or indicated slope, for finished surface of paving.
- H. Expansion and Control Joints: Provide for sealant-filled joints at locations and of widths indicated. Provide foam filler as backing for sealant-filled joints, unless otherwise indicated; where unfilled joints are indicated, provide temporary filler until paver installation is complete. Install joint filler before setting pavers. Sealant materials and installation are specified in Division 7 Section "Joint Sealants."
- I. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.
1. Install edge restraints to comply with manufacturer's written instructions. Install stakes at intervals required to hold edge restraints in place during and after unit paver installation.
 2. For metal edge restraints with top edge exposed, drive stakes at least 1 inch below top edge.
 3. Install job-built concrete edge restraints to comply with requirements in Section 03300 - CAST-IN-PLACE CONCRETE.
 4. Where pavers set in mortar bed are indicated as edge restraints for pavers set in aggregate setting bed, install pavers set in mortar and allow mortar to cure before placing aggregate setting bed and remainder of pavers. Cut off mortar bed at a steep angle so it will not interfere with aggregate setting bed.
 5. Where pavers embedded in concrete are indicated as edge restraints for pavers set in aggregate setting bed, install pavers embedded in concrete and allow concrete to cure before placing aggregate setting bed and remainder of pavers. Hold top of concrete below aggregate setting bed.
- J. Provide steps made of pavers as indicated. Install paver steps before installing adjacent pavers.
1. Where pavers set in mortar bed are indicated for steps constructed adjacent to pavers set in aggregate setting bed, install steps and allow mortar to cure before placing aggregate setting bed and remainder of pavers. Cut off mortar bed at a steep angle so it will not interfere with aggregate setting bed.

0.4 BITUMINOUS SETTING-BED APPLICATIONS

- A. Apply primer to concrete slab or binder course immediately before placing setting bed.

- B. Prepare for setting-bed placement by locating 3/4-inch-deep control bars approximately 11 feet apart and parallel to one another, to serve as guides for striking board. Adjust bars to subgrades required for accurate setting of paving units to finished grades indicated.
- C. Place bituminous setting bed where indicated, in panels, by spreading bituminous material between control bars. Spread mix at a minimum temperature of 250 deg F. Strike setting bed smooth, firm, even, and not less than 3/4 inch thick. Add fresh bituminous material to low, porous spots after each pass of striking board. After each panel is completed, advance first control bar to next position in readiness for striking adjacent panels. Carefully fill depressions that remain after removing depth-control bars.
 - 1. Roll setting bed with power roller to a nominal depth of 3/4 inch . Adjust thickness as necessary to allow accurate setting of unit pavers to finished grades indicated. Complete rolling before mix temperature cools to 185 deg F.
- D. Apply neoprene-modified asphalt adhesive to cold setting bed by squeegeeing or troweling to a uniform thickness of 1/16 inch. Proceed with setting of paving units only after adhesive is tacky and surface is dry to touch.
- E. Place pavers carefully by hand in straight courses, maintaining accurate alignment and uniform top surface. Protect newly laid pavers with plywood panels on which workers can stand. Advance protective panels as work progresses, but maintain protection in areas subject to continued movement of materials and equipment to avoid creating depressions or disrupting alignment of pavers. If additional leveling of paving is required, and before treating joints, roll paving with power roller after sufficient heat has built up in the surface from several days of hot weather.
- F. Joint Treatment: Place unit pavers with hand-tight joints. Fill joints by sweeping sand over paved surface until joints are filled. Remove excess sand after joints are filled.

0.5 MORTAR SETTING-BED APPLICATIONS

- A. Saturate concrete subbase with clean water several hours before placing setting bed. Remove surface water about one hour before placing setting bed.
- B. Apply mortar-bed bond coat over surface of concrete subbase about 15 minutes before placing setting bed. Limit area of bond coat to avoid its drying out before placing setting bed. Do not exceed 1/16-inch thickness for bond coat.
- C. Place reinforcing wire over concrete subbase, lapped at joints by at least one full mesh and supported so mesh becomes embedded in the middle of setting bed. Hold edges back from vertical surfaces approximately 1/2 inch.

- D. Place mortar bed with reinforcing wire fully embedded in middle of setting bed. Spread and screed setting bed to uniform thickness at subgrade elevations required for accurate setting of pavers to finished grades indicated.
- E. Mix and place only that amount of mortar bed that can be covered with pavers before initial set. Cut back, bevel edge, remove, and discard setting-bed material that has reached initial set before placing pavers.
- F. Wet brick pavers before laying if the initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.
- G. Place pavers before initial set of cement occurs. Immediately before placing pavers on setting bed, apply uniform 1/16-inch-thick, slurry bond coat to bed or to back of each paver with a flat trowel.
- H. Tamp or beat pavers with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each paver in a single operation before initial set of mortar; do not return to areas already set or disturb pavers for purposes of realigning finished surfaces or adjusting joints.
- I. Spaced Joint Widths: Provide 3/8-inch nominal joint width with variations not exceeding plus or minus 1/16 inch.
- J. Grout joints as soon as possible after initial set of setting bed.
 - 1. Force grout into joints, taking care not to smear grout on adjoining surfaces.
 - 2. Clean pavers as grouting progresses by dry brushing or rubbing with dry burlap to remove smears before tooling joints.
 - 3. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
 - 4. If tooling squeezes grout from joints, remove excess grout and smears by dry brushing or rubbing with dry burlap and tool joints again to produce a uniform appearance.
- K. Cure grout by maintaining in a damp condition for seven days, unless otherwise recommended by grout or liquid-latex manufacturer.

0.6 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.
- B. Pointing: During tooling of joints, enlarge voids or holes and completely fill with grout. Point up joints at sealant joints to provide a neat, uniform appearance, properly prepared for sealant application.

- C. Cleaning: Remove excess grout from exposed paver surfaces; wash and scrub clean.
 - 1. Remove temporary protective coating from brick pavers as recommended by protective coating manufacturer and as acceptable to unit paver and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

PART 4 - MEASUREMENT AND PAYMENT

0.1 MEASUREMENT

- A. Unit pavers will be measured by the square foot. All preparation and incidental work necessary to accomplish the installation will be considered incidental to the square foot price.

0.2 PAYMENT

- A. Payment for unit pavers will be made at the Contract unit price as specified above.

0.3 PAYMENT ITEMS

ITEM NO.	DESCRIPTION	UNIT
0426.100	PAVERS	SF

END OF SECTION

NOTES TO THE DESIGNER

- A. Any request to modify or waive the specification requirements listed below must be approved in writing by the MBTA's Director of Design:
 - 1. None